THE NUTRACEUTICAL NEXUS: UNVEILING THE COMPLETE NUTRIENT SOLUTION IN ONE PLACE

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Abstract

In today's fast-paced world, maintaining a balanced and nutritious diet can be a challenge. With busy schedules and limited time for meal preparation, individuals often find it difficult to consume all the necessary nutrients for optimal health. However, a revolutionary concept has emerged that promises a comprehensive solution to this problem - the Nutraceutical Nexus. The Nutraceutical Nexus represents a paradigm shift in the way we approach nutrition. It offers a convenient and efficient way to obtain a complete spectrum of essential nutrients in a single place. Nutraceuticals, a fusion of "nutrition" and "pharmaceuticals," are functional foods or dietary supplements that provide specific health benefits beyond basic nutrition. At the heart of the Nutraceutical Nexus lies a carefully curated selection of these innovative products. These nutraceuticals are formulated to address specific nutritional needs, catering to various aspects of health and wellness. Whether it's boosting immunity, improving cognitive function, promoting joint health, or enhancing overall vitality, the Nutraceutical Nexus offers a diverse range of options tailored to individual requirements.

Keywords- nutraceutical, nutrients, vitamins, minerals, plants, fruits

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1. Introduction

Nutraceuticals were first introduced by Stephen L. De Felice in 1989, he was the founder and chairman of the foundation of innovation medicine in New York [1]. Nutraceuticals come from the two words 'Nutrient' and 'Pharmaceuticals' because these are genetically engineered herbal or processed food to help the patient overcome the ailment and maintain a healthy life which helps to increase the life expectancy of the individual as well as the future generation. Nutraceuticals are compounds, formulations, or food products that are used for their high nutritional values as well as therapeutic agents in high metabolic disorders like Diabetes, Hypertension, Endocrine disorders as well as various disorders due to oxidative stress like Alzheimer's Disease and Parkinson's Disease [2]. Modulations of P-glycoproteins in the case of Alzheimer's by certain polyphenolic nutraceuticals. Nutraceuticals have been in concept since 3000 years when Hippocrates *father of medicine* stated "let food be your medicine", with time many countries started working on the diet to maintain a healthy lifestyle [3]. In the early 1900s, the USA started adding Iodine in salt to prevent goiter. Similarly, countries like Germany, France, Japan, Canada, and the USA started working on nutraceuticals and selling food products like pills and powders. In India, since 2016 nutraceuticals started to play a major role as herbs are an important part of nutraceuticals in a country like India with great biodiversity and ethnicity in case of various medical plants available across the country from the Himalayas to Kanyakumari and Gujarat to Assam various Ginkgo, ginger, black pepper, ashwagandha, garlic, ginseng, turmeric [4]. There are various types of nutraceuticals from natural sources and synthetic sources these substances help to overcome obesity and various disorders originating due to a lack of day-to-day life exercise and proper diet [5]. Various nutraceuticals are present in the different categories (Figure 1).

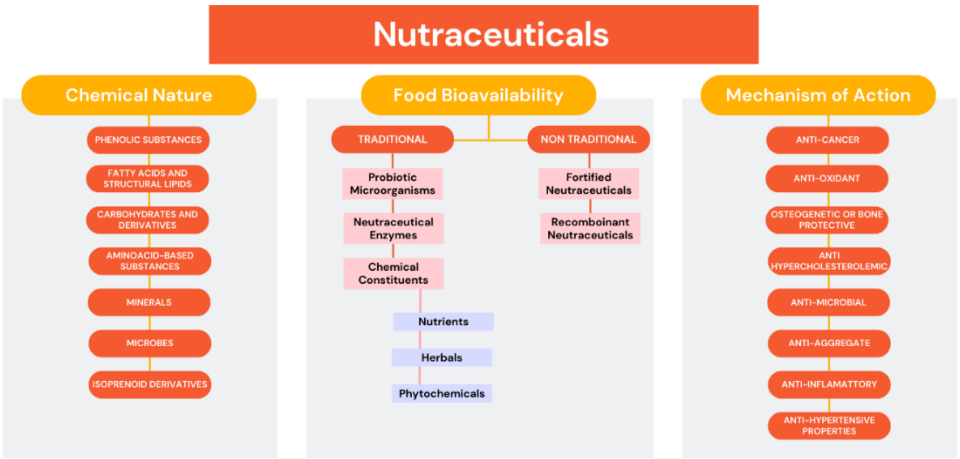

Figure 1: Types of Nutraceuticals

2. Role of nutraceutical on Socio-Economic

During Pandemic Nutraceutical Industries played a vital role by providing people with products that helped them to increase their immunity and keep their hearts healthy. Green tea supplements, omega 3 fatty acid supplements, probiotics, Vitamin B12, and Vitamin C are some of the products in the market which helped people to maintain their immune systems and fight the pandemic [6]. The size of the world market for nutraceuticals, estimated at USD 454.55 billion in 2021, is anticipated to rise at a 9.0% compound annual growth rate (CAGR) from 2021 to 2030 [7]. Over the course of the forecast period, the market is anticipated to be driven primarily by the rising demand for functional foods and dietary supplements. The market for dietary supplements is expected to be driven by an optimistic perspective on medical nutrition due to its increasing utilization in the treatment of cardiovascular disease and malnutrition. Over the projection period, it is anticipated that the growing senior population and rising healthcare costs would support the expansion of the worldwide functional food business [8]. Functional meals have a favourable reputation with consumers, largely because of the additional health and wellness advantages these products provide. The total growth has been assisted by the rising elderly population, rising healthcare costs, changing lifestyles, innovative food products, and expectations for higher prices [9]. Dietary fibre and minerals are expected to increase in popularity due

to the widespread knowledge of their advantages for maintaining physical and total health. While minerals help increase nutrient absorption and passage into cells and stimulate blood coagulation, fibers tend to ease bowel motions and provide essential internal organ cleansing. The market is also anticipated to grow in size during the forecast period as a result of the increasing acceptance rates of herbal medicines among people throughout the world due to growing worries over the potentially dangerous side effects of traditional pharmaceutical drugs [10, 11].

The demand for nutritional supplements and functional foods has increased because of the COVID-19 epidemic. Over the past year, the popularity of immunity-boosting supplements has significantly altered consumer behaviour and purchasing habits. Additionally, following the COVID-19 pandemic, people's daily life will likely include preventive healthcare practices like taking dietary supplements. As a result, the global COVID-19 epidemic has made it possible for nutraceuticals to establish a significant market presence [12, 13]. Businesses have adopted mergers and acquisitions and new product launches to compete in the market as major strategies. Companies were able to increase the scope of their product offerings and boost product quality thanks to acquisitions and mergers. Additionally, bringing new products to market has helped businesses provide better-quality goods, adapting to shifting consumer demands across the board. In the worldwide nutraceuticals market, some notable participants are present (Table 1) [14].

Table 1: Various companies are involved in nutraceutical formulation and marketing

S. No	Companies
1	Omni Active
2	Nuritas
3	Zivo Bioscience
4	Zeon Lifesciences Limited
5	Lactonova Nutripharm
6	AOR Canada
7	Amway Corporation
8	Arkpharma Laboratories
9	Herbalife Ltd
10	Nestle

At USD 4-5 billion, India's nutraceutical business is poised to lead the world. By 2025, it is anticipated to increase by over 18 billion USD [15]. According to studies, the market for dietary supplements in India is currently valued at USD 3924.44 million and is expected to expand by 22% annually to USD 10,198.57 million by 2026 [16]. The ongoing epidemic and the growing significance of preventative healthcare have caused this industry to grow rapidly.

The Indian populace has started to believe in immunity-boosting drugs, which has significantly changed consumer behaviour and market behavior Examples of the flexible shopping habits of consumers of healthcare products include vitamin capsules, chewable tablets, and gummies [17].

During the pandemic, preventive healthcare has emerged as a crucial line of defence, demonstrating the nutraceutical industry's value as a reliable source of income for the populace. Even after the pandemic's intensity has diminished, demand for nutraceuticals is surging. The second wave demonstrated that the market presence of the nutraceutical industry has grown and will continue to do so [18]. The nutraceutical business in India can step up to battle health challenges in India amid an ongoing pandemic and considerably contribute to India's Gross Domestic Product because the global market for nutraceuticals is substantial at around USD 117 billion (GDP) [15]. To boost immunity, the consumption of potential nutrients and micronutrients such vitamin A, vitamin D, vitamin c, folate, selenium, and zinc has significantly increased.

Numerous substances can be incorporated in the daily diet to potentially develop immunity or protection against the coronavirus, according to a study by Nutrition and Dietary Supplements. Incorporate polyphenols, legume seeds containing plant protease inhibitors, as well as proteins like whey protein, into your diet on a regular basis [19].

3. Statistics about the global nutraceutical market

Currently, the USA, Japan, and Europe hold 90% of the global nutraceutical market. The global market should reach USD 336 billion by 2023 from

USD 247 billion in 2019 at a compound annual growth rate (CAGR) of 8%, the global market is expected to expand from USD 247 billion in 2019 to USD 336 billion by 2023 [20]. The global nutraceutical market has experienced significant growth, with an estimated value of $382.51 billion in 2020 and projected growth to reach $722.49 billion by 2027. North America leads the market, followed by Asia-Pacific, driven by consumer awareness and a health-conscious population. Functional foods and dietary supplements are the key segments, with increasing demand for convenient health solutions. The market benefits from the growing aging population, which seeks preventive healthcare and targeted nutrition. Functional ingredients, such as omega-3 fatty acids and antioxidants, play a vital role in nutraceutical products. The rise of e-commerce and direct-to-consumer sales channels has further accelerated market growth. Overall, the nutraceutical market shows great potential for continued expansion in the future.

4. Statistics about the Indian Nutraceutical Market

The nutraceutical companies are now focusing on developing economies in the Asia Pacific region after these worldwide markets have reached maturity. Only 2% of the worldwide nutraceutical market's share was held by the Indian market in 2017, and as of 2019, it is anticipated to be worth $5 billion [21]. By 2023, it is projected to reach USD 11 billion, growing at a CAGR of 21%. Throughout the pandemic, the Indian nutraceuticals market has grown at a 25% annual rate. Additionally, foreign direct investment (FDI) grew from 131.4 million USD in FY12 to 584.7 million USD (FY19).

India is anticipated to have at least a 3.5% market share of the worldwide market by 2023. In FY20, India exported pharmaceuticals worth USD 16.3 billion [22]. India exported pharmaceuticals worth USD 15.86 billion in FY21 as of November 2020. In FY20 and October 2020, pharmaceutical exports totalled USD 2.07 billion and USD 16.28 billion, respectively. India's urban populace has never been more concerned with its physical well-being. This is giving India's nutraceuticals industry a tremendous opportunity for expansion. As a result, the industry is anticipated to experience rapid growth.

Manufacturers and marketers of nutraceuticals have developed innovative strategies to inform consumers about the product, its advantages, and its use in both medical treatment and preventative healthcare. Players in the industry are also launching several initiatives on their own, with a renewed emphasis on higher product quality standards, increased transparency, and competitive pricing for innovations [23]. This will help Nutraceuticals gain ground in the health and wellness market. The nutraceutical market already controls 67% of the supplement business, which is dominated by the pharmaceutical industry [24].

5. Potential Investment Areas

The herbal market in India is predicted to make up 30% of the nutraceutical's supplements market, with a CAGR of 20% from 2015 to 2023 [25]. In the Indian market, there is a change from curative to preventive treatment. Due to the pandemic's focus on immunity, customers are turning more and more to functional foods. Vitamins like plant protein, vegan Omega-3, sea minerals like calcium and magnesium, fibres like fenugreek, probiotics, and black garlic have become essential to people's lifestyles, and accessibility of nutraceuticals has significantly improved in all geographies of India, leading to a significant growth through B2C and D2C channels [26] (Figure 2).

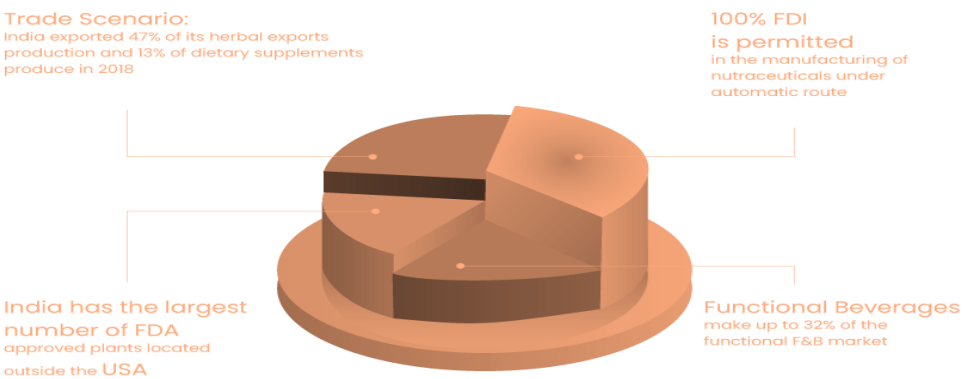

Figure 2: Various Companies Involved in Manufacturing of Nutraceutical

6. Alfalfa

Medicago sativa L., also known as alfalfa, is a crucial forage species for hay and pasture. Although it originated in southwest Asia, the United States, where around 11 million ha are cultivated each year, is able to grow it successfully in a variety of climates and soils [27]. Due to its enormous yields and nutritional content, alfalfa has earned the title "Queen of the Forages." In North America, at than 160 cultivars were created for production between 1900 and 1975. The majority of the more recent cultivars were chosen for their enhanced adaptability and multiple insect resistance [28]. Medicago sativa, widely known as lucerne or alfalfa, is a perennial flowering plant in the Fabaceae family of legumes. It is grown as a significant forage crop in numerous nations all over the world. It serves as a cover crop, hay, silage, and a source of green manure.

The variety of varied species that make up the widely dispersed genus Medicago are either annual or perennial. According to the most recent taxonomic research on the perennial species, M. sativa is polymorphic. In North America, alfalfa is a common name. In countries like the United Kingdom, South Africa, Australia, and New Zealand, the name lucerne is more frequently used. And the plant is young, when trifoliate leaves with round leaflets are the majority, the plant superficially resembles clover, a cousin in the same family [29]. The leaflets lengthen as they mature. It bears clusters of tiny purple flowers that are followed by fruits with 10–20 seeds that are spiralled in two to three rotations. Warmer temperate areas are where alfalfa originated. Since the time of the ancient Greeks and Romans, at least, it has been grown as cattle feed. Due to the fibre, protein, minerals, vitamins, chlorophylls, and carotenoid content of alfalfa (Medicago sativa), it has been widely utilised as animal feed. In addition to coumestrol, daidzein, and genistein, three of the most prevalent phytoestrogens, it has also been shown to be a good source of phenolic compounds like quercetin, naringenin, medicarpin, myricetin, kaempferol, luteolin, apigenin, and formononetin. Studies from several fields back up the medicinal advantages of phenolic compounds. Flavonoids and other phenolic chemicals have antioxidant properties that are also responsible for their antimicrobial, anti-inflammatory, immuno modulatory, and anticancer activities [30]. Various compounds present in alfalfa the protein level was found to be higher than that found in other foods, including well-known plant-based sources of protein such beans (19.2%) and amaranth (12.9%). However, the results for Adps (alfalfa derived products) revealed significant levels of Ca and Na (nearly twice as much in FDJ as compared to RM) (1.3 higher in FDJ than RM).

These products are excellent for customers who have lactose intolerance due to the high Ca content. Other minerals, such as Fe and Zn (always in higher concentrations in FDJ), were quantified in Adps at levels greater than those found in beans, which are generally recognised to be a strong source of these elements (5.90 mg Fe/100 g and 2.83 mg Zn/100 g) [31]. Thus, consuming these Adps may help to prevent anaemia brought on by iron deficiency. Vegetables contain additional bioactive compounds besides nutrients and minerals. These come in a variety of chemical forms, including anthocyanins, carotenoids, and porphyrin pigments. The two most common porphyrins found in vegetables are chlorophyll a and b [32]. Chlorophyll a and b contents were measured in this study in the Adps taken at various harvest periods, varying in all batches examined. In RM and FDJ, the levels of chlorophyll a varied between 12.41 and 505.58 and 8.19 and 66.32 lg/g, respectively. Chlorophyll b concentrations were higher in (55.44-269.8 lg/g) in contrast. Previous reports of lysine, arginine, aspartic, and glutamic acids in Medicago species have been reported. The amino acid profile of both Adps has been identified in the current study[33]. Medicago species have been shown to contain lysine, arginine, aspartic, and glutamic acids in the past. The amino acid composition of both Adps has been examined in the current investigation. In both products harvested at various times, all essential amino acids (EAA), including histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, and valine, were identified and quantified [34]. Histidine was the less common EAA, with leucine and lysine dominating. Alanine, arginine, glutamic and aspartic acids, glycine, proline, and tyrosine are nonessential amino acids (NEAA). Alfalfa (Medicago sativa) is a plant species native to the Middle East and South Asia. It is also known as lucerne, and is widely cultivated as a forage crop for livestock, as well as for human consumption [35]. This versatile plant is known for its high nutritional value and has been used in traditional medicine for centuries to treat a wide range of health conditions. Here is a summary of the key findings from recent research on alfalfa:

Nutritional value: Alfalfa is an excellent source of vitamins, minerals, and antioxidants, including vitamins C and K, calcium, iron, and chlorophyll. It is also a good source of protein and dietary fiber. These nutrients make alfalfa a great addition to a healthy diet and a natural alternative to synthetic vitamin supplements [36].

Anti-inflammatory properties: Alfalfa contains a variety of anti-inflammatory compounds, including saponins, phytoestrogens, and flavonoids. These compounds help to reduce inflammation and swelling in the body, making alfalfa a useful natural remedy for conditions such as rheumatoid arthritis, osteoarthritis, and other inflammatory disorders [37].

Antioxidant activity: Alfalfa is rich in antioxidants, which help to protect cells from oxidative stress and damage. Antioxidants are essential for maintaining good health, and can help to reduce the risk of chronic diseases such as heart disease, cancer, and Alzheimer's disease [38]

Cholesterol-lowering effects: Alfalfa has been shown to have cholesterol-lowering effects, which can be beneficial for people with high cholesterol levels. The saponins in alfalfa have been shown to bind to cholesterol and prevent its absorption, while the fiber in alfalfa helps to promote healthy digestion and elimination [39].

Blood sugar regulation: Alfalfa has been shown to have a positive effect on blood sugar regulation, making it a useful natural remedy for people with diabetes. The high fiber content of alfalfa helps to regulate glucose levels, and the antioxidants in alfalfa may help to protect against diabetic complications [40].

Cancer prevention: Some studies have shown that alfalfa may have potential as a cancer preventative agent. The phytoestrogens in alfalfa have been shown to have antiproliferative and anti-tumour effects, while the antioxidants in alfalfa help to protect cells from oxidative stress and damage [41].

Other benefits: Alfalfa has been used in traditional medicine to treat a variety of other health conditions, including digestive problems, kidney and bladder disorders, and skin conditions. While more research is needed to fully understand the effects of alfalfa on these conditions, preliminary studies have shown promising results [42].

In conclusion, alfalfa is a nutritious plant with a wide range of health benefits, including anti-inflammatory, antioxidant, and cholesterol-lowering effects. It may also have potential as a cancer preventative agent and for treating other health conditions. However, more research is needed to fully understand the effects of alfalfa on human health, and to determine the optimal dosage and formulation for each condition. Alfalfa (Medicago sativa) is a plant species native to the Middle East and South Asia and is widely cultivated as a forage crop for livestock and for human consumption. This plant is known for its high nutritional value and has been used in traditional medicine for centuries to treat a variety of health conditions. While alfalfa is generally considered safe for human consumption, it is important to consult with a healthcare provider before using alfalfa for medicinal purposes. This is especially important for individuals taking medications or with pre-existing medical conditions, as alfalfa may interact with certain medications or exacerbate certain medical conditions (Figure3 and Table 2).

Figure 3: Image of Alfalfa

Table 2: Biological effect of various preparations of Alfalfa

S.No.	Products	Formulation	Manufacturing	Uses	References
1	Alfalfa	Tablets	Merlion Naturals	an abundant supply of minerals and vitamins Aids in blood purification and immune function and promotes a healthy energy level encourages breastfeeding mothers to produce more milk; supports Improved Digestive Health Promotes Healthy Kidney Functions Supports Hair Health	[43]
2	Alfalfa Extract	Liquid	Hollywood Secrets	In addition to being rich in protein, alfalfa is a good source of calcium and vitamin A, two essential vitamins and minerals. The cleansing properties of alfalfa may prevent dry skin. Alfalfa contains vitamins B1 and B6, which may stimulate and encourage hair development.	[43]
3	Alpha 01	powder	Kiwi health care	In addition to being rich in protein, alfalfa is a good source of calcium and vitamin A, two essential vitamins and minerals. The cleansing properties of alfalfa may prevent dry skin. Alfalfa contains	[44]

				vitamins B1 and B6, which may stimulate and encourage hair development.	
4	Alfalfa tonic	Tonic for children	Hering Pharma	Treatment of Anaemia, Weight Loss, weakness	[45]
5	Alfalfa	Seeds	Urban Platter	For detoxing	[46]
6	Alfalfa Capsules	Capsules	Just Jaivik	In addition to being rich in protein, alfalfa is a good source of calcium and vitamin A, two essential vitamins and minerals. The cleansing properties of alfalfa may prevent dry skin. Alfalfa contains vitamins B1 and B6, which may stimulate and encourage hair development.	[47]
7	Alfalfa	powder	Just Jaivik	In addition to being rich in protein, alfalfa is a good source of calcium and vitamin A, two essential vitamins and minerals. The cleansing properties of alfalfa may prevent dry skin. Alfalfa contains vitamins B1 and B6, which may stimulate and encourage hair development.	[48]
8	Alfalfa	Syrup	Dr. Willmar Pvt Ltd	Diabetic tonic	[49]

Conclusion

In conclusion, the Nutraceutical Nexus represents a groundbreaking concept that revolutionizes the way we approach nutrition and provides a comprehensive solution to the challenges of maintaining a balanced and nutritious diet. With its promise of a complete nutrient solution in one place, the Nutraceutical Nexus addresses the modern-day struggle of busy schedules and limited time for meal preparation. By offering a diverse range of nutraceuticals, specifically formulated to cater to various aspects of health and wellness, the Nutraceutical Nexus empowers individuals to conveniently obtain essential nutrients. Whether it's boosting immunity, improving cognitive function, promoting joint health, or enhancing overall vitality, this innovative concept ensures that individuals can access the specific nutrients they need for optimal well-being.

The holistic approach of the Nutraceutical Nexus eliminates the need for juggling multiple supplements or adhering to various dietary plans. Instead, individuals can rely on a single platform to meet their nutritional needs comprehensively. This simplicity and convenience make it easier for people to integrate proper nutrition into their daily lives, regardless of their busy schedules. Moreover, the Nutraceutical Nexus goes beyond mere convenience. These nutraceutical products undergo rigorous testing and adhere to strict quality standards, providing a level of reliability and safety for consumers. The assurance of effectiveness and scientifically backed solutions further enhances the credibility and trustworthiness of the Nutraceutical Nexus. The global nutraceutical market's rapid growth is a testament to the increasing demand for health and wellness products. With the Nutraceutical Nexus at the forefront of this market, individuals can take control of their nutritional intake and prioritize their well-being in a fast-paced world. This concept caters to a wide range of consumers, from health enthusiasts and fitness enthusiasts to individuals seeking preventive healthcare and improved overall vitality.

Furthermore, the Nutraceutical Nexus aligns with the shifting consumer preferences towards personalized and targeted nutrition. By offering a curated selection of nutraceuticals that address specific nutritional needs, this concept caters to individual requirements and preferences. This customization ensures that individuals can focus on their unique health goals and tailor their nutrient intake accordingly.

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